NORTHEAST FLOOD STUDIES

REPORT

ON

REVIEW OF SURVEY

FOR

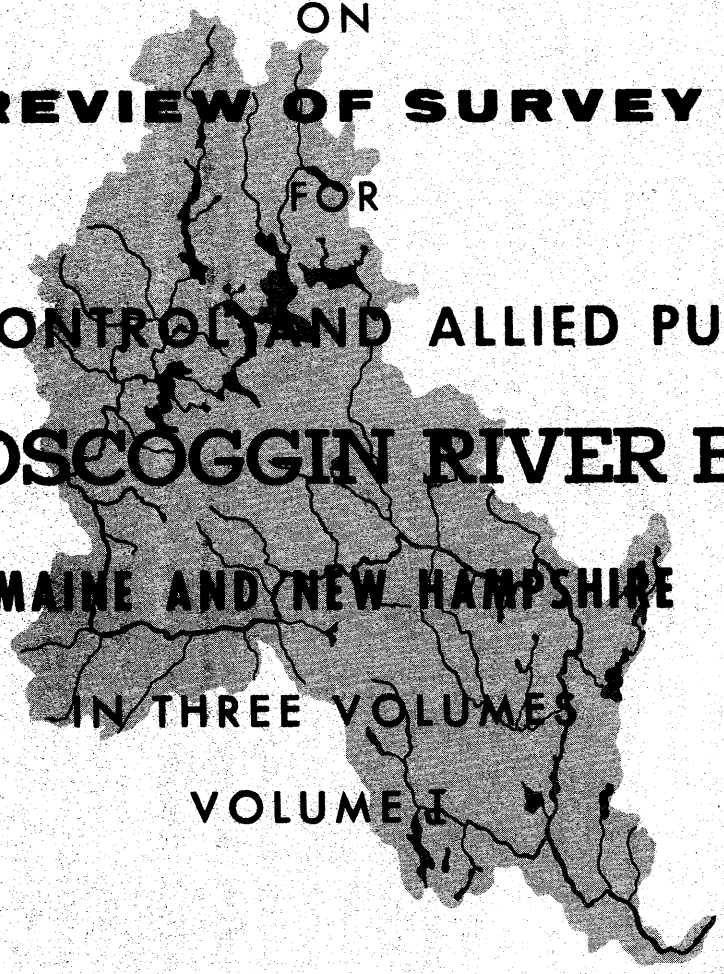
FLOOD CONTROL AND ALLIED PURPOSES

ANDROSCOGGIN RIVER BASIN

MAINE AND NEW HAMPSHIRE

IN THREE VOLUMES

VOLUME I



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

22 JUNE 1967

REPORT

ON

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FOR

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MAINE AND NEW HAMPSHIRE

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
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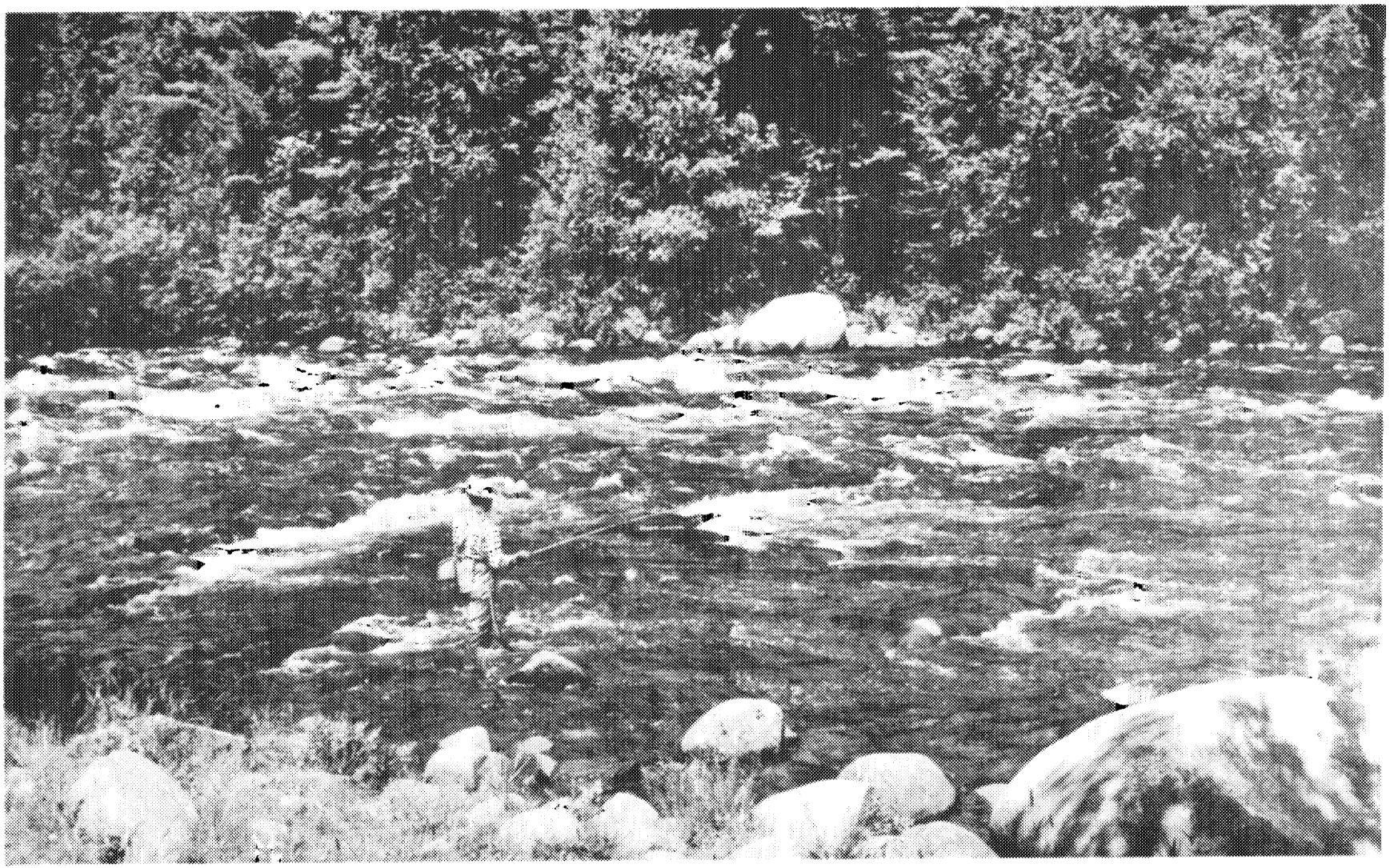

Courtesy of STATE of NEW HAMPSHIRE

Photo by DOUGLAS ARMSDEN

COOL, CLEAR WATER! -- One of the good fishing stretches in the Androscoggin River along the Thirteen-Mile Woods section between Milan and Errol, New Hampshire, offers " big water " with landlocked salmon and brook and rainbow trout.

SYLLABUS

The Division Engineer finds that extensive areas devoted to industrial, commercial, and residential usage along the main stem of the Androscoggin River and its tributaries are subject to periodic flooding. He further finds that the demand for water-oriented recreational opportunities are growing and that output from the development of the hydroelectric power resources of the basin could readily be programmed into the forecast loads of the area. Development of the Pontook site on the Androscoggin River in Dummer, New Hampshire in part, could meet these needs.

Development of the considered project at the Pontook site would provide for storage of waters for flood control, hydroelectric power generation, and recreation. The dam and reservoir could store 238,000 acre-feet of water for flood control, power generation, and recreation with generating facilities totaling 300,000 kilowatts.

Opposition to the project has developed due to its adverse impact on the valuable existing fish and wildlife resources of the area which would be inundated. The Thirteen Mile Woods reach of the river is considered by many to be one of the last of the "wild rivers" in the East and an important cold-water fishery. Deer wintering yards would also be flooded by the project.

Due to these factors and the fact that alternative means of meeting the electric peak load demands could be provided at less cost, the Division Engineer finds that Federal construction of the Pontook project is not warranted at this time.

Other methods for solving the flood problems in the Androscoggin River Basin were considered. These included structural measures such as the construction of reservoirs, local protection by means of dikes and floodwalls or diversion of flood waters, channel improvements and combinations of these measures. Non-structural measures such as flood plain zoning for damage prevention and the establishment of river encroachment lines were also considered, and flood plain information studies have been approved for the cities of Auburn and Lewiston.

All of the foregoing indicate that structural measures for the reduction of flood damages in the Androscoggin River Basin are not warranted at this time. No economical opportunities for meeting other water resource development needs were found. The Division Engineer recommends no water resource improvements in the basin at this time.

REPORT ON REVIEW OF SURVEY FOR FLOOD CONTROL AND ALLIED PURPOSES

ANDROSCOGGIN RIVER BASIN MAINE AND NEW HAMPSHIRE

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-R

22 June 1967

SUBJECT: Report on Review of Survey for Flood Control and Allied Purposes, Androscoggin River Basin, Maine and New Hampshire

TO: Chief of Engineers
ATTN: ENGCW-PD

SECTION I - AUTHORITY

1. AUTHORIZING RESOLUTION

Following the New England hurricane floods of 1955, the Committee on Public Works of the United States Senate, on 21 November 1955, adopted a resolution which reads, in part:

> "That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review previous reports on the . . . Androscoggin River, Maine and New Hampshire . . . . with a view to determining the desirability of modifying the recommendations contained in such previous reports and the advisability of adopting further improvements for flood control and allied purposes, in view of the heavy damages and loss of life caused by recent hurricane floods in the New England area."

SECTION II - SCOPE

2. SCOPE OF REPORT

This report, in full response to the authorizing resolution insofar as it pertains to the Androscoggin River, comprises a review of the flood and related water resource problems in the basin, and presents the results of the investigations. The area covered by this report is shown on Plate 1.

3. SCOPE OF INVESTIGATION

a. Surveys and studies. Maps prepared by the Corps of Engineers for use in studies for prior flood control reports, maps prepared by the U. S. Army Map Service and the U. S. Geological Survey, and local maps were used in the study. Topographic surveys made especially for this report consisted of centerline profiles at three studied damsites. Subsurface explorations, by borings, were made at two damsites. Surveys of flood damages were made after the flood of 1936, reviewed in detail in 1951 and 1952 for the NENYIAC report (see paragraph 4b), again following the March 1953 flood, and updated for this report. These reviews included field examinations and personal interviews with individuals and officials of industries and municipalities experiencing flood losses. Office studies consisted of hydrologic and hydraulic analyses, engineering studies, and estimates of quantities and cost of construction items.

b. Consultation with interested parties. Public hearings were held in Berlin, New Hampshire and Lewiston, Maine on 13 and 14 December 1960, respectively, at which time interested parties requested consideration of improvements in various areas in the basin. Subsequent public meetings, under the sponsorship of local and civic groups, have been held at which the Pontook project, considered in this report, was discussed. Meetings have also been held with State, County and local officials and with private individuals.

c. Field reconnaissance. Field reconnaissance of the problem areas has been made by the Division Engineer and his representatives.

SECTION III - PRIOR REPORTS

4. PRIOR REPORTS

Development of the water resources of the basin has been considered in the following published reports:

a. "308" Report. A report dated 12 July 1929 and printed as House Document No. 646, 71st Congress, 3d Session, concluded that improvements for navigation, flood control, power development, and irrigation

in the Androscoggin River basin were not warranted at that time.

b. NENYIAC Report. This comprehensive report, prepared by the New England-New York Inter-Agency Committee, inventoried the resources of the New England-New York area and recommended a master plan to be used as a guide for regional planning, development, conservation, and use of land, water, and related resources. Chapter VII of Part Two covers the Androscoggin River basin. Section VI of Chapter VII reported investigations for flood control and found that, under the criteria adopted for the report, the provision of storage for flood control in single or multiple-purpose reservoirs would not be warranted at that time. In Section VII, the undeveloped hydroelectric power potential of the basin was evaluated and a plan presented consisting of seven hydroelectric developments. The report was submitted to the President of the United States by the Secretary of the Army on 27 April 1956. Part I and Chapter 1 of Part 2 were printed as Senate Document No. 14, 85th Congress, 1st Session.

SECTION IV - DESCRIPTION

5. LOCATION AND EXTENT

The Androscoggin River basin is located in the southwestern part of Maine and the northeastern part of New Hampshire. It extends from the Canadian border at the boundary between the states of Maine and New Hampshire to 8 miles below tidewater at Brunswick, Maine. The basin has a length of about 110 miles and a width of about 65 miles and covers an area of 3,450 square miles, of which 2,730 are in Maine and 720 are in New Hampshire. A map of the basin is shown on Plate No. 1.

6. TOPOGRAPHY AND GEOLOGY

The Upper Androscoggin Basin lies mostly within the White Mountain Section of the New England Physiographic Province. The river has its source from the high watershed on the west central border of Maine and from the northeast portion of New Hampshire north of the Presidential Range. The mountainous terrain is broken by several relatively wide stream valleys and, locally, there are large basins occupied by great lakes such as the Rangeleys and others that are connected to discharge to the Androscoggin.

Prior to glaciation, the topography was in a mature stage of erosion with a network of sharply incised stream valleys having

The White Mountains in New Hampshire
showing part of the Presidential Range

graded profiles. Lakes and swamps did not exist and the overburden was the product of weathering of the bedrock. Glaciation modified this topography by erosion and deposition and disrupted the drainage system. There are evidences that the present circuitous, south and easterly course of the Androscoggin River is altered from a pre-glacial drainage westward to the Connecticut River Valley.

Glacial till, a mass mixture of soil and rock debris of all sizes scraped up and transported by the ice, variably blankets the bedrock surface throughout most of the Upper Basin. The till is thin or absent at high elevations and of considerable thicknesses on lower hill slopes and in the valley sections. Overlying the till in the valleys and in local basins are sorted deposits of glacial materials that were outwashed from the ice by meltwaters and deposited as sand and gravel terraces and plains.

The bedrocks of the basin, except for an area of relatively young slates and volcanics near the Rangeley Lakes, are very old sediments that have been metamorphosed to schist, gneiss and quartzite. These rocks have been much folded to a general northeasterly trend of structure and are frequently cut by igneous intrusions of a mainly granitic composition.

The pegmatites (coarse-grained granites) of the basin are a source of marketable minerals, principally feldspar, mica, and beryl with subordinate occurrences of rare minerals and minerals of gem quality. Principal production has been from the Rumford-Newry area at several intermittently operated mines and quarries, none of which are affected by reservoir plans. The glacial sands and gravel deposits, occurring as terraces and plains in the major valleys, are the only resources of a mineral nature that would be affected by reservoir construction.

Screw Auger Falls in Grafton Notch, Maine
A scenic attraction close to State Route 26

7. STREAM CHARACTERISTICS

a. Main Stream. The Androscoggin River proper starts at the outlet of Umbagog Lake in the town of Errol, New Hampshire. The main stem is 169 miles long between Errol Dam and its mouth in Merrymeeting Bay, descending a total of 1,245 feet in the 161 miles above tidewater. It has two steep drops, 240 feet in 2.5 miles at Berlin, New Hampshire and 180 feet in 1.6 miles at Rumford, Maine. Of the 1,094-foot fall on the main stem of the river between the Sawmill Dam in Berlin and Brunswick, 789 feet has been developed by private interests for hydroelectric power purposes.

b. Tributaries. As shown on Plate 1, there are a large number of tributaries to the Androscoggin River, many of which are a source of high runoff during periods of intensive rains, snowmelt, or a combination of both.

8. AREA MAPS

The Androscoggin River and its watershed are shown on quadrangle sheets of the U. S. Geological Survey at a scale of 1:62,500.

9. WEATHER AND FLOODS

In general, the climate of the basin is characterized by relatively cool summers and long, cold, snowy winters, especially in the inland areas. The average annual temperature is about 43°F and ranges from 45°F at points near the coast to below 40°F in the headwaters. Extremes in temperature range from occasional highs slightly in excess of 100°F to infrequent lows below minus 30°F. The frost-free period varies from 110 days in the higher portions of the basin to 160 days near the coast. Lying in the path of the "prevailing westerlies", which often include cyclonic disturbances that approach from the west and southwest, the basin is subject to frequent but short periods of heavy precipitation. The basin is also exposed to occasional coastal storms, some of tropical origin, that travel up the Atlantic seaboard.

The mean annual precipitation over the basin is about 40 inches, distributed rather uniformly throughout the year. It varies from below 35 inches in the headwater lakes area to over 60 inches in the White Mountains at the southwestern edge of the basin. Much of the winter

precipitation comes in the form of snow. With an annual snowfall that varies from 80 inches near the coast to 170 inches in the headwaters, it can be expected that the water content of the snow cover, nearly every spring, will amount to 6 to 8 inches over the entire basin, with 10 inches or more in the higher elevations of the White Mountains.

Major floods are caused principally by a combination of heavy rainfall and melting snow in the spring of the year. The three largest floods of record since 1892 occurred in the spring - in March 1936, April 1895, and March 1953. Major floods in the same period attributable to heavy rainfall alone were experienced in October 1959 and November 1927. The two largest floods of this century (March 1936 and March 1953) had peak discharges of 74,000 and 56,700 cubic feet per second respectively, at Rumford, Maine (drainage area 2,067 square miles). Based on an analysis of peak discharge-frequency curves computed for all gaging stations in the basin, these floods have recurrence intervals of 100 years and 30 years, respectively.

Since preliminary studies indicated that local flood protection measures were not economically justified at this time, a standard project flood was not developed for the basin. However, the record flood of March 1936 was used as a demonstration flood. A spillway design flood of 152,000 cubic feet per second was adopted for a dam at the Pontook site (drainage area 1,215 square miles).

SECTION V - ECONOMIC DEVELOPMENT

10. POPULATION

The basin encompasses all or parts of 59 towns, 5 plantations and 2 cities in Maine, and 11 towns, 14 unincorporated places, and one city in New Hampshire. The population of the basin, based on the 1960 Census, numbers 167,000, of which 145,000 are in Maine and 22,000 are in New Hampshire.

The distribution of the population, as defined in the 1960 Census, is 67 percent urban and 33 percent rural, with all of the urban population concentrated in two cities and portions of 6 towns in Maine and one city in New Hampshire. Urban areas and other places having populations in excess of 5,000 are listed in Table 1.

TABLE 1

POPULATION - ANDROSCOGGIN RIVER BASIN

MAJOR URBAN AREAS

Town and State	1960 Population
Lewiston, Maine	40,804
Auburn, Maine	24,449
Berlin, N. H.	17,821
Brunswick, Maine	15,797
Rumford, Maine	10,005
Mexico, Maine	5,043
Lisbon, Maine	5,042

11. TRANSPORTATION

The transportation pattern in the basin reflects the distribution of population. The more populous southern and central portions of the basin are served by a network of highways, while the thinly populated northern area has fewer roads. The main highways are U. S. Nos. 1, 2, I-95 and 202, and States Routes Nos. 4, 5, 16, 17 and 26, and the Maine Turnpike. Freight service is provided by the Maine Central Railroad which serves the towns in the eastern portion of the basin, the Canadian National Railroad (Grand Trunk) which crosses the watershed from Portland, Maine, to Berlin, New Hampshire, and the Boston and Maine Railroad which connects Berlin with Whitefield, New Hampshire. Two commercial and one military airfield and 9 small airports are located within or adjacent to the basin. The Androscoggin River has not been improved for commercial navigation.

12. MANUFACTURING

Manufacturing is of great importance to the economy of the basin, with about two-thirds of the towns engaging in manufacturing to some extent. The largest of the manufacturing centers are located along the main stem, and provide employment to about 26,000 of the estimated 32,000 manufacturing workers in the basin. Over 65 percent of the 26,000 employees work in the manufacturing centers located in the lower reach of the river.

The more important manufacturing centers in the basin and their principal products are: Auburn and Lewiston with the greatest concentration of shoe and textile mills in the State, other products being electronic elements, sheet metal, printing, bricks, lumber products, baking and canned foods: Berlin - pulp, paper and allied products, athletic footwear, knit goods and foundries; Brunswick - canned food, shoes, brushes and lumber products; and Rumford - paper and paper products. In the Maine section of the basin, the value of products produced in 1962 was $295,700,000 with 21,000 workers receiving $81,188,000 in wages. This reflects an increase since 1957 of 16% in output, 14% in wages paid with practically no change in number of wage earners. Expenditure for plant improvement in Androscoggin County, Maine was $6.6 million in 1962, about 2-1/4 times the expenditure for 1957.

13. AGRICULTURE

About 20 percent of the basin is in farm land with much of that land devoted to wood lots. The suitability of land for agricultural crop purposes varies throughout the basin. The mountainous upper area in New Hampshire and Maine consists of relatively wide major valleys with many lakes and swamps, with the few part-time farms scattered through the southern fringe of the area. The central portion of the basin, a hilly plateau with hills generally rising to elevations of 1,000 to 2,000 feet above sea level, is predominantly dairy area. The lower section of the basin, with broadly rolling hills rising to elevations of 500 to 600 feet above mean sea level, and the Rangeley Lake area are well suited for all farm crops. Near the coast, truck farming on sandy soil near large centers of populations is the major agricultural activity. Many of the farms include dairy enterprises with the primary source of farm income from dairy products and poultry. Other farm income is from livestock, field crops, vegetables, fruits and nuts, horticultural specialties, and forest products. In 1963, farm income in Maine totalled $64 million.

14. WATER SUPPLY

An abundance of water exists in the basin from the 438 miles of streams with safe yields in excess of one million gallons per day, the many miles of streams with significant yields of less than one million gallons per day, and the many lakes and ponds in the region. The minimum mean monthly flow at Brunswick, Maine is about 1,143 million gallons per day. Although there are about 320 miles of streams receiving significant pollution, the quantity of water available at the present time exceeds foreseeable future water demands. At the present time, no municipal

water supplies are taken directly from the Androscoggin River between Berlin, New Hampshire and Merrymeeting Bay, Maine.

15. HYDROELECTRIC POWER

There are 31 existing hydroelectric plants in the basin with a total installed capacity of 161,771 kilowatts. Of these plants, thirteen are operated by public utilities and develop 84,943 kilowatts, with the remaining 18 plants owned by industrial concerns with a total capacity of 76,828 kilowatts. Electrical energy in the Maine portion of the basin is marketed principally by investor-owned utility companies whose transmission lines are interconnected with neighboring utilities for inter-change purposes.

16. RECREATION

While manufacturing, lumbering, and retailing are the principal occupations throughout the basin, income from recreation is an important factor in the economy of the area. The scenic environment, numerous lakes, and cool climate attract great numbers of visitors during the summer months. The high quality of fishing and abundant wildlife account for considerable sportsman use during the spring and fall seasons.

17. FORESTRY

More than 80 percent of the land area of the basin is forested. It provides raw material for the wood-using industries in the valley and supports directly or indirectly about one-fourth of the population of the basin. Most of the forest land, except in mountainous areas, is of good quality, and produces commercially valuable species of timber such as spruce, fir, pine, beech and birch. Large holdings of forest lands are managed for sustained yields.

18. MINERALS

Various mineral deposits are found in the Androscoggin River basin, the most important being sand, gravel and pegmatite. Data are not available on the total production of sand and gravel but the output based on 10 producers exceeds that of any other mineral commodity in tonnage and value in the basin. Pegmatite materials, found in the middle and southern part of the basin, are mined for feldspar, beryl, and mica, these sources accounting for most of the output of these minerals in the state of Maine. Other mineral commodities commercially utilized in the basin are: clay for paper and allied products, ceramic and brick; granite for building material; and

peat for agricultural purposes. Estimated reserves of air-dried peat are believed to be about 2,000,000 tons.

SECTION VI - EXTENT AND CHARACTER OF FLOODED AREA

19. GENERAL

Stretches of the Androscoggin's main valley on both sides of the river are subject to flooding in the lower 130-mile length of the river from Berlin to Brunswick. The relatively steep slope of the stream combined with the topography of the valley precludes extensive areal flooding; however, the areas subject to inundation are moderately well developed. A substantial portion of the basin's industrial complex is located in the flood plain as well as key segments of its transportation network and public utilities. Manufacturing, the largest source of employment in the basin, suffers most from flooding. Mainly oriented toward paper making, the area's industry also produces textiles, leather products and gypsum products. Residential and commercial properties in the larger communities along the stream are also flood-prone, particularly in Rumford, Mexico, Lewiston, and Auburn in Maine and in Gorham, New Hampshire. Agriculture, a declining segment in the valley's economy, suffers only minor losses.

SECTION VII - FLOOD DAMAGES

20. EXPERIENCED FLOOD DAMAGES

The record flood of March 1936 caused damages estimated at $4,392,000 and disrupted the normal economy of the basin. Four lives were lost and 1,500 families were made temporarily homeless. Communication in the valley and with the outside world was practically cut off as eighteen bridges were destroyed, rail and road facilities were extensively damaged and telephone and telegraph facilities were severed. Some of the valley towns were without power and water. Over 40 percent of the damages were to industry, 20 percent to urban properties, with the rest to highways, railroads and utilities. All but $160,000 of the losses were in the State of Maine. Greatest losses were experienced in the Rumford-Mexico, Brunswick-Topsham, and Lewiston-Auburn reaches of the river in Maine. New Hampshire losses were largely concentrated in the Berlin-Gorham area. The second greatest flow at the Rumford gage was recorded in April 1895; however, no damage information is available on this flood. The third largest recorded flood in the Androscoggin River basin occurred in March 1953. Total damages in the 1953 flood were estimated at $2,230,000. Significant areas of damage in this flood occurred

along the main river from Berlin to Brunswick, and on three of the tributary streams - the Dead River in New Hampshire and the Swift and Little Androscoggin Rivers in Maine. Industrial losses represented the largest single item of loss, almost 40 percent, with other principal losses occurring to urban (residential and commercial), public utilities, and the transportation network. In Mexico, at the junction of the Swift River and the main stem of the Androscoggin, 100 families evacuated their homes and the business section of the town was closed as the Swift River overflowed Main Street.

21. RECURRING LOSSES

A recent field review of potential losses in the Androscoggin River Valley indicates a recurrence of the record flood of March 1936, under current economic conditions, would cause losses estimated at $13,700,000 along the main stem of the river from the Sawmill Dam in upper Berlin to tidewater at Brunswick. Twenty industrial complexes, employing over 9,000 people would suffer the major share of the damages, 65 percent of the total estimated loss. Pulp and paper product manufacturers at Berlin and at Rumford, Jay, Livermore Falls and Topsham, Maine as well as textile plants at Lewiston, Lisbon Falls and Brunswick, Maine would be hardest hit.

22. CURRENT ANNUAL LOSSES

Recurring losses for various stages of flooding were converted to average annual losses by correlation between stage-discharge and discharge-frequency relationships in each of 15 damage reaches of the main river. Average annual losses on the main stem amount to $735,000 under current economic conditions.

23. TRENDS OF DEVELOPMENT

The Androscoggin River basin has a stable, relatively prosperous economy. Back-boned by the paper making industry, the basin in Maine is a highly industrialized portion of the state. The section of the river in New Hampshire below the Sawmill Dam at Berlin has an economy geared to one large paper company. Based on past and current economic development in the basin, an overall economic growth rate of 0.75 percent annually over the next 50 years is considered probable in the Maine portion of the basin with a leveling-off trend probable for the 50-year period thereafter. In the New Hampshire portion of the basin, while little growth is expected, the progressive policies of the one company which governs industry in the area makes it unlikely that there will be any decline in the area's economy in the future.

24. FUTURE ANNUAL LOSSES

Flood damages in the Maine portion of the basin can be expected to increase at least as fast as the overall economic growth rate under present land use practices. On an average annual equivalent basis, losses will be increased by 18.6 percent in the reaches from Rumford to tidewater at Brunswick. Average annual losses over the next 100 years are estimated to amount to $830,000 at 1966 price levels.

SECTION VIII - IMPROVEMENTS BY FEDERAL AND NON-FEDERAL AGENCIES

25. EXISTING IMPROVEMENTS BY FEDERAL AGENCIES

No Federal agencies have constructed any projects for flood control or other beneficial use of water in the basin. The Weather Bureau office at Portland, Maine issues general warnings of degree of flooding to Rumford and Lewiston whenever flood stage is anticipated. Also, during the period of flood hazard in the spring, the Weather Bureau issues bulletins evaluating existing flood potential in the state of Maine for distribution to news media.

26. PROPOSED IMPROVEMENTS BY OTHER FEDERAL AGENCIES

The Soil Conservation Service, United States Department of Agriculture, pursuant to authority contained in the Watershed Protection and Flood Prevention Act (Public Law 566), has an approved Watershed Work Plan for the Dead River in New Hampshire and is studying a plan for the Nezinscot River in Maine. Projects under consideration include small retarding structures and channel improvements.

27. IMPROVEMENTS BY NON-FEDERAL AGENCIES

The river has been developed by private interests for storage and power production. Plate 1 shows the location of the seven privately-owned, major storage lakes having a total usable storage capacity of 661,000 acre-feet located above Errol. All of the lakes except Kennebago are operated for the benefit of downstream users.

Existing flood control improvements in the basin are of a limited local nature. Local interests, in some instances with State assistance, have provided various types of flood prevention works in their communities. In

Gorham, the channels of the Moose and Peabody Rivers were cleared of boulders and the boulders utilized in dikes. A short section of earth dike was also constructed adjacent to the south bank of the Androscoggin River. In Rumford, a bridge was lengthened to increase its waterway area, an overflow-type dam was modified to increase its discharge capacities, a dike was constructed between the Oxford Paper Company properties and the Androscoggin River, and a short wall was constructed by the Works Progress Administration to protect a section of road on the right bank of the Androscoggin river upstream of Rumford.

Boundaries of areas vulnerable to flooding have been established by the City of Auburn. Ordinances regulate and restrict the location, construction and use of buildings and land in these areas. In Rumford, voters failed to adopt a similar zoning law.

SECTION IX - IMPROVEMENTS DESIRED

28. PUBLIC HEARINGS

To obtain the views of those interested in water resource development in the Androscoggin River basin, public hearings were held in Berlin, New Hampshire and Lewiston, Maine on 13 and 14 December 1960, respectively. Approximately 50 people attended each hearing including representatives of Federal, State and local governments, industrial establishments, civic organizations, and interested individuals.

29. BERLIN HEARING

The Mayor of Berlin briefly described the damage to the city from past floods on the Dead River.

Representatives of Gorham requested a flood control dam for the Peabody River and diversion of floodwaters from the Moose River into Moose Brook. A flood control dam and reservoir with recreational facilities on the Moose River was suggested by representatives of Randolph. Other individuals requested the dredging and removal of debris from the Androscoggin River, upstream of Shelburne, and restoration of the existing deteriorated wood dam at Pontook Reservoir.

30. LEWISTON HEARING

Several persons including representatives of local governments requested that regulation of water for pollution abatement be considered in the study of

the resources of the basin. Representatives of Rumford and Wayne cited damage from past floods to their communities and contiguous areas. A representative of Rumford also suggested the diversion of flood waters into Wyman Brook, below the community. A representative of Wayne requested the construction of a dam on the Dead River to prevent floodwaters and seasonal high waters on the Androscoggin River from flowing back into Androscoggin Lake. Representatives of several industrial establishments briefly described the facilities they use to reduce the discharge of pollutants into the river. A representative of the League of Women Voters of Maine urged maximum use of resources in the basin for power development, flood control, water supply, irrigation, recreation, and stream regulation.

SECTION X - FLOOD PROBLEMS, RELATED PROBLEMS AND SOLUTIONS CONSIDERED

31. FLOOD PROBLEMS

Destructive floods in the basin are caused principally by a combination of heavy rainfall and melting snow. Nearly every spring, melting snow alone produces high flows on the rivers. Although most of the major floods occur in the spring, some have occurred in the fall. A contributing factor in the development of damaging downstream floods is the rapidity of runoff from the tributaries located in the mountainous areas below Errol. In almost every community, rural buildings and land, and transportation facilities located along the stream have suffered damages from floods. The flood problem will worsen with time due to growth, particularly in the lower portion of the basin. The overall economy of the basin is expected to grow a total of 37.5 percent in 50 years and then remain stable for the following 50 years. The flood problem is expected to increase at a comparable rate.

32. RELATED PROBLEMS

a. General. In addition to periods of great surplus of water, the basin is subject to periods of low stream flow. Improvement in the distribution of flows offers present and future opportunities for meeting other water needs and accommodating water-oriented purposes such as water supply, pollution abatement, hydroelectric power, and recreation. These water resource needs and problems are discussed in the following paragraphs.

b. Water Supply. At the present time, no municipal water supplies are taken directly from the Androscoggin River. About 70 percent of the people served by municipal systems along the waterway utilize surface supplies from tributary streams, while the remaining 30 percent obtain

their supplies from ground sources or a combination of ground and surface sources. Berlin has a water supply reservoir in the Connecticut River Basin.

At present, Rumford and Mexico are seeking sources of additional water supply for domestic and industrial use. This demand could be met through development of storage in the studied Hale Reservoir on the Swift River. The Water District has indicated that it is not interested in this source of supply and will investigate other areas for possible future development of a reservoir or wells.

The Brunswick-Topsham Water District indicated it would be interested in considering water supply together with flood control as a joint venture with the Federal government but no feasible project was found in the vicinity.

c. Hydroelectric Power. In the period between 1950 and 1960, the combined requirements for electric power in the basin have increased about 1.8 times. In Power Supply Areas 1 and 2, which encompass all of New England, the Federal Power Commission, in its "National Power Survey" (1964) estimates that the peak load demand in 1970 will be nearly double the 1960 peak and will be more than triple the 1960 peak by 1980. In view of the current magnitude of the power requirements and its expected growth, the development of hydroelectric power was considered in conjunction with the flood control studies for this report. Studies by the Commission indicate that the hydroelectric power which could be developed from any potential in the basin could be effectively utilized when available.

d. Recreation. Studies made by the National Park Service and the Bureau of Outdoor Recreation show that a need exists in the basin for the development of additional publicly owned water-oriented recreational facilities, and that this need will expand in the future. The New Hampshire Department of Resources and Economic Development has expressed the belief that the Pontook project has an excellent potential for the development of outdoor recreation facilities.

e. Water Quality. The Androscoggin River valley has long been the scene of manufacturing activity. Of major importance is pulp and paper manufacturing which utilizes the stream's flow for hydro-power and waste disposal and also the forest resources for raw material. As industry and population expanded, the use of the river for waste disposal created nuisance conditions. During the summer months of 1940, 1941, and 1942, particularly obnoxious conditions existed due to the pollutional load in the river. Public demand for improvement of the stream resulted in a continuing program to

regulate pollution of the Androscoggin by the States and industry. The program has been conducted under a series of decrees by the Supreme Judicial Court of Equity for Androscoggin County, Maine. The decrees have required the controlled discharge of sulfite waste liquors, the maintenance of a sampling and analysis program during the summer months by industry, and the construction of certain control facilities. Requirements of the Court decrees have been supervised by a court-appointed administrator since 1948.

The controls placed on industry have been aimed at the prevention of a public nuisance while permitting use of the river as a means of disposing of industrial waste and municipal sewage. Reports indicate that the controls have succeeded in removing some of the undesirable results of gross pollution.

Although the condition of the river has improved since 1940, analysis of data for the summer months of 1961, obtained from the offices of the Attorney General of Maine by the Public Health Service of the Department of Health, Education, and Welfare, indicates the Androscoggin River remains polluted. The pollution assimilation capacity of the river is so utilized that the quality is maintained at a level that will just prevent the development of obnoxious odors.

In recent years, as a result of changes in pulp and paper manufacturing processes, discharge of sulfite waste liquors has been discontinued at all plants in the Androscoggin River basin. This discontinuance of the sulfite process has noticeably reduced the pollution in the river; however, the discharge of wastes from sulfate pulp and paper production without treatment still remains a major pollution problem. Large expansion programs presently underway at three major companies along the river will contribute additional pollution. The Public Health Service, Department of Health, Education, and Welfare (now the Federal Water Pollution Control Administration, Department of the Interior) made a detailed study of the water quality control needs of the river. In order to evaluate the present and future need for water quality control though storage releases, the Service assumed that all municipal and industrial wastes discharged into the Androscoggin River would receive secondary treatment or its equivalent. The study found that, after adequate treatment, the water quality of the Androscoggin River, as measured by dissolved oxygen, would be satisfactory for all legitimate water uses through the year 2070, and concluded that there is no present or known future need for storage on the main stem of the Androscoggin River for water quality control purposes.

f. Comprehensive Planning. In the formulation of water resource development plans, consideration was given to all potential reservoir sites in the basin and those which showed promise of feasibility were studied in detail. The potential hydroelectric power projects in the comprehensive basin plan developed by the New England-New York Inter-Agency Committee in 1955 (see paragraph 4b) were re-examined. In the development of plans for reservoir projects, all possible uses were carefully considered to insure that the full economic potentialities as well as the social values of the site were fully and properly considered. The Pontook project considered in this report is adapted from one of the seven projects discussed in the New England-New York Inter-Agency Report. Plate No. 1 shows the location of the various projects studied for this report.

33. SOLUTIONS CONSIDERED

a. Object. The object of this investigation was the development of a plan of water resource improvements which would alleviate the flood problem and other related water resource problems of the basin. This study evaluated the needs for water conservation, water quality control, water supply, fish and wildlife conservation and enhancement, recreation, and hydroelectric power.

Detailed investigations and analyses of potential flood improvement projects made during prior basin studies were reviewed. The more favorable sites of improvements considered were up-dated in design, and projects re-evaluated at present-day construction costs and valley conditions to determine their economic feasibility at this time. A description of the Pontook multiple-purpose project is given in Section XI. Other projects studied are briefly noted in the sub-paragraphs immediately following.

b. Reservoir Sites. Over 50 reservoir sites were investigated for this report. Of these, 30 were considered worthy of a preliminary cost analysis. Based upon the data acquired from this analysis, it was found that 11 reservoir sites should be further studied. Of these 11 sites, Pontook on the Androscoggin River, Ellis on the Ellis River, and Hale on the Swift River were found to warrant additional consideration, and of these, only the Pontook project was found to warrant detailed study. Attention was also given to flood prevention and other projects requested at the hearings.

c. Local Protection. Local protection works were considered for the communities in which flood damages were confined to a reasonably concentrated area. Nine communities - Berlin and Gorham, New Hampshire, and Rumford, Mexico, Lewiston, Auburn, Lisbon Falls, Topsham, and Brunswick, Maine, all located along the main stem of the Androscoggin River -

and one community, Wayne, Maine, on the shore of Androscoggin Lake, were studied in some detail. Protective works considered for the majority of the communities included dikes, floodwalls, and channel improvements and, where tributary streams contributed to the flood damages, upstream dams were also considered. At Wayne, consideration was given to a higher control structure on the Dead River at the outlet to Androscoggin Lake. At Rumford, consideration was also given to the diversion of floodwaters around the community. Studies of these projects indicate that no structural improvement is economically justified at this time.

SECTION XI - PLAN OF IMPROVEMENT

34. GENERAL

Consideration was given to meeting the water resources needs insofar as possible through full development of the Pontook site. Hydroelectric power, recreation, and flood control were included as project purposes. Since the Pontook project would be suitable for peaking power purposes, releases from the turbines would be concentrated for short periods. This would require construction of a downstream dam and reservoir to reregulate the flows to permit efficient use of the water at downstream locations. The proximity of the main reservoir to the reregulating pool suggested the possibility of a pumped storage project. The use of reversible power units was considered but found to be not warranted at this time.

35. CONSTRUCTION FEATURES

The principal features of the Pontook project include a main dam, located in the town of Dummer, and a reregulating dam, located approximately 6.5 miles downstream of the main structure, in the town of Milan. Since upstream storage is controlled by private interests to provide regulated flow at Berlin, necessary discharge control facilities are needed in the reregulating dam to stabilize the fluctuating flows from a peaking power plant at the main dam. The sites selected for the dams are geologically and topographically suited for the structures. Limits of the several pools and land required for the project are shown on Plate 2. A brief description of the project follows, with pertinent data summarized in Table 2.

a. Description.

(1) Main Dam and Reservoir. The main dam, with a full pool at elevation 1,220 mean sea level datum, would create a reservoir impounding a gross capacity of 238,000 acre-feet. The reservoir would contain dead

TABLE 2

PERTINENT DATA
PONTOOK PROJECT

	Main Dam	Reregulating Dam
Distance above mouth, miles	151	144.5
Drainage area, square miles		
Gross	1,215	1,273
Net	170	58
Dam		
Type	Rock-fill	Rolled-earth
Maximum height, feet	106	53
Length, feet	1,170	2,200
Top elevation, m.s.l.	1,230	1,136
Spillway (tainter-gated)		
Length, feet	120	135
Crest, elevation, m.s.l.	1,180	1,095
Gates, number and size		
Tainter gates	3-40' x 40'	3-45' x 26'
Power intake	9-13' x 40'	---
Log sluice	1- 6' x 18'	1- 6' x 20'
Water surface elevations, m.s.l.		
Maximum design surcharge	1,224	1,133
Full pool	1,220	1,121
Maximum power pool	1,220	---
Minimum power pool	1,180	---
Normal tailwater	1,121	---
Surface areas, acres		
Full pool	7,470	1,160
Maximum power pool	7,470	---
Minimum power pool	2,760	---
Storage capacities, acre-feet		
Flood control, power, & recreation	207,000	---
Reregulating	---	15,000
Dead	31,000	1,300
Total	238,000	16,300
Power installation		
Installed capacity, kw	300,000	---
Power head, net, feet		
Maximum	97	---
Average	93	---
Minimum	57	---
Maximum drawdown, feet	40	20
Regulated flow, c.f.s.		
Maximum	---	6,531
Minimum	---	1,724
Average	---	2,217
Average (excluding amounts in excess of 2,500 c.f.s.)		2,085

storage of 31,000 acre-feet below elevation 1,180 and 207,000 acre-feet for power generation, flood control storage, and recreation between elevations 1,180 and 1,220.

The principal dam, of rock-fill construction, would include a powerhouse with generating facilities totalling 300,000 kilowatts. The full-load discharge from the three turbines would be 42,000 cubic feet per second. A tainter-gated spillway, capable of passing a peak discharge of 138,000 cubic feet per second would be provided. Other facilities would include a log sluice, concrete non-overflow section adjacent to the spillway and a rock-fill dike near the east abutment of the dam.

(2) Reregulating Dam and Pool. The reregulating dam would create a pool with a surface area of 1,160 acres and usable pondage of 15,000 acre-feet to reregulate releases from the main powerhouse. A tainter-gated spillway, with a discharge capacity of 75,000 cubic feet per second would regulate the discharge from the pool to flows usable at downstream plants.

b. Recreation. The full pool would provide a lake about 16 miles long with a surface area of 7,470 acres. Normal daily operations of the power pool would result in a drawdown of one foot or less during the summer recreation season, thus preserving its attractiveness for recreational pursuits. Consistent with public safety and operation of the project, the entire periphery of the main reservoir and adjacent lands would be open to public use. Initial facilities would provide for such activities as swimming, picnicking, camping, boating, hunting, fishing, and other water-related uses. No recreational facilities would be provided for the pool or shore area of the reregulating reservoir since the pool surface would fluctuate from the sudden releases of large quantities of water at start of peak power generation of the main dam power plant.

c. Relocations. Construction of the Pontook project would require relocation of about 13½ miles of Route 16 and about one mile of a 115KV transmission line in the reservoir of the main dam, and about one mile of Route 16 and 5 miles of a secondary road in the pool area of the reregulating dam. An existing privately-owned, single lane steel girder logging bridge spanning the Androscoggin River, would also require reconstruction.

d. Real Estate Requirements.

(1) Main Dam. A total of 11,300 acres would be needed for the damsite, reservoir, and relocations.

(2) Reregulating Dam. Approximately 1,900 acres of land would be needed for the damsite, reservoir, and relocations.

36. METHOD OF OPERATION

The Pontook power plant would be operated for peaking power as required by load demands on the system. Storage behind the main dam would be operated in conjunction with storage in the existing Rangeley Lakes system for optimum use for flood control, power, and recreation.

During flood conditions downstream flood control regulation would become dominant. After passage of the flood or flood threat, the stored flood waters would be released as rapidly as possible, usually through the turbines, consistent with downstream channel capacities and stages. Normal power operations would resume as the flood receded.

The primary function of the reregulating dam would be to store and reregulate the high flows from the peaking power plant at the main dam. The entire project would be operated in accordance with regulating procedures which would best utilize the available water.

37. DEGREE OF PROTECTION

Table 3 indicates the effect that the regulation would have in reducing flood stages at various points along the Androscoggin River during a flood similar to the largest flood of record in the basin, that of March 1936.

TABLE 3

EFFECT OF RESERVOIR REGULATION
ON RECURRING MARCH 1936 FLOOD

Location	Observed (c.f.s.)	Modified (c.f.s.)	Reduction (c.f.s.)	Reduction (%)
Pontook Dam	16,000	8,000(1)	8,000	50.0
Berlin, N. H.	19,900	12,000(2)	7,900	39.6
Rumford, Maine	74,000	66,500	7,500	10.1
Auburn, Maine	118,000	113,000	5,000	4.2

(1) During development of flood, outflow curtailed to power requirements of 1,724 c.f.s.

(2) During development of flood, with flow from Pontook curtailed to 1,724 c.f.s., flow at Berlin would be 9,000 c.f.s. After flood crest has passed downstream damage centers, releases from Pontook would be increased so that flow at Berlin would not exceed 12,000 c.f.s. (Safe Channel Capacity).

SECTION XII - ESTIMATES OF FIRST COSTS AND ANNUAL CHARGES

38. FIRST COSTS

Unit prices used in estimating construction and relocation costs in this report are based on average bid prices for similar work in the same general region, adjusted to 1966 price level. Costs of electrical, mechanical and hydraulic equipment was obtained from published prices and consultations with manufacturers. Valuations of property are based on surveys at the project site, including information from local officials on recent sales in the area. Included in the costs is a contingency allowance which also provides for minor items of work not in the specific items of the estimates. The costs for engineering and overhead are based on knowledge of the site and experience on similar projects. The total investment includes interest during construction at the rate of 3-1/8 percent for the average expenditure over a construction period of four years and the present worth of recreation facilities that would be added in the future as usage grows. For purposes of this report, it was estimated that additional recreation facilities would be added at five year intervals throughout the life of the project, for a total cost of future recreation facilities of $1,200,000.

39. ANNUAL CHARGES

Annual charges are based on an annual interest rate of 3-1/8 percent with the investment amortized over a 100-year period. Allowances were made for maintenance, operation and major replacement costs, for loss of taxes on lands transferred to Federal ownership, and for net losses to fish and wildlife (see paragraph 44).

40. COST ESTIMATE

Estimates of first costs, investment costs, and annual charges for the Pontook project are summarized in Table 4.

TABLE 4

COST SUMMARY - PONTOOK PROJECT
(1966 Price Level)

FIRST COSTS	
Lands and Damages	$ 2,000,000
Relocations	4,950,000
Reservoir Clearing	3,150,000
Main Dam	19,230,000
Reregulating Dam	4,760,000
Power Plant	30,090,000
Recreation Facilities	830,000
Buildings, Grounds and Utilities	130,000
Permanent Operating Equipment	40,000
Engineering & Design	3,430,000
Supervision & Administration	4,690,000
INITIAL FIRST COST	$ 73,300,000
Future Additions for Recreation	1,200,000
ULTIMATE PROJECT COST	$ 74,500,000
INVESTMENT COSTS	
First Cost	$ 73,300,000
Interest during construction	4,581,000
Present worth of future additions for recreation	405,000
TOTAL PROJECT INVESTMENT	$ 78,286,000
ANNUAL CHARGES	
Interest and Amortization	$ 2,565,000
Maintenance, Operation and Replacements	711,000
TOTAL FINANCIAL ANNUAL CHARGES	$ 3,276,000
Loss of taxes on land	26,000
Net loss to fish & wildlife	662,000
TOTAL ECONOMIC ANNUAL CHARGES	$ 3,964,000

SECTION XIII - ANNUAL BENEFITS

41. FLOOD PREVENTION BENEFITS

Construction of the Pontook project would reduce flood flows along the entire length of the Androscoggin River from Berlin to tidewater and would provide substantial protection to presently flood prone properties. In a recurrence of the record flood of 1936, under today's conditions, the reservoir would prevent $3.9 million in losses. Annual flood damage prevention benefits amount to $239,000.

42. HYDROELECTRIC POWER BENEFITS

Hydroelectric power benefits were based on the cost of providing equivalent power by the most likely alternate source which, in this study, is considered to be a privately-financed pumped storage plant to serve the same market area. Power values were derived by the Federal Power Commission on the following basis:

(1) Based on past and expected growth in the power market area that would be served by the Pontook project, the electrical output of the power installation could be readily programmed and effectively absorbed as soon as available.

(2) Values of $10.30 per kilowatt of dependable capacity and 4.4 mills per kilowatt-hour for energy at the high tension side of the project step-up substation were based on production costs of an alternative pumped storage plant and associated transmission facilities, and project transmission facilities, all privately financed. In testing for economic feasibility of adding hydroelectric power to the project, the separable costs of such addition were compared with the costs of an equivalent publicly-financed pumped storage plant. In this latter instance, values of $4.80 per kilowatt and 4.4 mills per kilowatt-hour were also derived by the Commission.

(3) A value of 4 mills per kilowatt-hour was determined as the value of increased energy produced at existing power plants downstream of the project as a result of the additional usable flow from the Pontook reservoir.

The monthly load curve in New England has and is expected, in the foreseeable future, to continue to have its maximum peak in December. Dependable capacity at the main power plant was therefore based on minimum flow and minimum head in December. It was determined that the installed capacity of 300,000 kilowatts would be dependable with a minimum December load factor of 5.8 percent on a 5-day per week basis.

Based on the above values, power benefits and alternative costs to the Pontook project are computed as follows:

	Benefits		Alternative Cost	
Dependable capacity - 300,000 KW	@ $10.30 =	$3,090,000	@ $4.80 =	$1,440,000
Energy at site - 115,000,000 KWH	@ 0.0044 =	506,000	@ 0.0044 =	506,000
Increased energy at existing downstream projects - 12,000,000 KWH	@ 0.004 =	48,000	@ 0.004 =	48,000
	Total	$3,644,000		$1,994,000

43. GENERAL RECREATION BENEFITS

General recreation benefits would result from the development of reservoir areas and contiguous land for public use. The initial annual visitation at Pontook, upon completion of the recreational development, is estimated to be 110,000 visitor-days with the annual visitation reaching 404,000 visitor-days by the end of the assumed 100-year project life. Average annual benefits from these visitations are estimated to be $289,000.

44. FISH AND WILDLIFE EFFECTS

An evaluation of the effect of the project on fish and wildlife resources has been made by the Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Department of the Interior. The studies include the derivation of annual losses and gains of fisherman-days of stream fishery and lake fishery as well as annual losses of hunter-days for deer, upland game, and waterfowl. The net economic loss to the fish and wildlife resources that would result from construction of the Pontook project based on values in accordance with Supplement No. 1 to Senate Document 97, 87th Congress, was found to be approximately $662,000 annually which is included as a project cost.

45. REDEVELOPMENT BENEFITS

The construction of the Pontook project would produce significant economic benefits in the region centered in Berlin. All of Coos County, of which Berlin is the largest community, has been designated as a

Redevelopment Area by the Area Redevelopment Authority under Title IV, Section (d) of Public Law 89-136, Public Works and Economic Development Act of 1965. The project, by putting to work labor currently unemployed or under-employed, may therefore be credited with the wages paid to such labor. The "redevelopment" benefit to such employment is estimated to be $5,800,000. Expressed as an equivalent annual value, this amounts to $176,000. No redevelopment benefits are credited to the annual costs for operation, maintenance, and major replacements.

46. SUMMARY OF BENEFITS

The total annual benefits creditable to the project for flood control and allied purposes are summarized below.

TABLE 5

SUMMARY OF AVERAGE ANNUAL BENEFITS
(1966 Price Level)

Source of Benefit	
Flood Prevention	$ 239,000
Hydroelectric power	3,644,000
General recreation	289,000
Sub-total	$ 4,172,000
Redevelopment	176,000
Total annual benefits	$ 4,348,000

SECTION XIV - PROJECT FORMULATION AND ECONOMIC JUSTIFICATION

47. MAXIMIZATION OF NET BENEFITS

The first step in determining the optimum development of the Pontook site was the establishment of project purposes. Consideration was given to all water uses. The Federal Power Commission indicated a growing need for peaking power. The Bureau of Outdoor Recreation cited the growing need for additional water-oriented recreational developments. The Public Health Service of the Department of Health, Education, and Welfare found that, after adequate treatment of pollution at its source, the Androscoggin River

water quality would be satisfactory for all legitimate uses through the year 2070 and therefore water quality storage was not considered. The Service also found that there is ample water in the basin to supply all projected municipal and industrial water supply needs to at least the year 2070. The formulation process therefore narrowed to three project purposes: flood control, hydroelectric power, and recreation.

Benefits for flood control and recreation are relatively constant over a fairly wide range of storages and pool elevations, whereas power benefits, particularly capacity benefits, are affected by changes in these values.

Within these parameters, it was found that the optimum power development would be a 300,000 kilowatt installation with a full (December) power pool at elevation 1,220, based on storage adequate to maintain a dependable flow of 1,724 c.f.s. Further studies indicated that the most effective use of the storage would provide 10.9 inches of flood control storage in Pontook in the spring (with more being provided when snow surveys indicated the need), and a full pool for recreation in the summer.

48. ECONOMIC JUSTIFICATION

The benefit-cost ratio for the project, exclusive of redevelopment benefits, is 1.02. Including redevelopment benefits, the project has a benefit-cost ratio of 1.1.

In accordance with the policies and standards set forth in Senate Document No. 97, 87th Congress, 2nd Session, each purpose must be economically feasible as the last added; that is, the separable cost (the cost of adding any purpose) must be less than the benefits to that purpose, and also less than the cost of the least costly alternative project evaluated on a comparable basis.

In the case of power, based on values furnished by the Federal Power Commission, the cheapest alternative measure is the cost of an equivalent, comparably-financed pumped storage power plant excluding taxes and insurance, even though construction of such a plant probably would not be undertaken in the absence of the water project.

Tabulated below are the separable costs for the three project purposes in the Pontook project, the benefits for each purpose, and the cost of the least costly alternative, all on an annual basis.

Purpose	Separable Cost	Benefits	Alternative Cost
Power	$2,227,000	$3,644,000	$1,994,000
Flood control	5,000	239,000	279,000
Recreation	107,000	289,000	1,732,000

Since the separable cost for power is greater than the least costly alternative, the addition of hydroelectric power to the project is not justified and the project is not warranted.

Consideration of a single-purpose flood control project and a two-purpose flood control and recreation project resulted in benefit:cost ratios of less than unity.

SECTION XV - ALLOCATION AND APPORTIONMENT OF COSTS

49. ALLOCATION OF COSTS TO PROJECT PURPOSES

The Pontook project would include three purposes: flood control, power, and recreation. As noted in paragraph 48 above, the separable cost for inclusion of power is greater than the alternative cost. In this situation, allocation of costs to various project purposes is unnecessary.

50. APPORTIONMENT OF COSTS BETWEEN FEDERAL AND NON-FEDERAL INTERESTS

Since the project is marginal in economic justification, fails in the comparability test, and would cause large scale losses to fish and wildlife, no development is recommended and no apportionment of costs is necessary.

SECTION XVI - COORDINATION WITH OTHER AGENCIES

51. GENERAL

Coordination with Federal and State agencies having an interest in the Pontook improvement was carried out during the course of the report studies. The agencies reviewed the plans for the various projects considered and furnished comments and recommendations relative to the phase of development in which they have a primary interest. The agencies include: The U. S. Department of the Interior (Fish and Wildlife Service), Bureau of Outdoor Recreation, the National Park Service, the Federal Water Pollution Control Administration, the Federal Power Commission, the Department of Health, Education, and Welfare, the Soil Conservation Service of the Department of Agriculture, and the New Hampshire Department of Resources and Economic Development, and the Department of Public Works and Highways. A letter of comment from the Federal Power Commission is made Attachment I to this report.

SECTION XVII - DISCUSSION

52. DISCUSSION

a. General. The investigation of the Androscoggin River basin was undertaken to determine the advisability of adopting further improvements for flood control and allied purposes. Various Federal and non-Federal agencies were contacted during the investigation for information concerning water supply, water quality, hydroelectric power, recreation, and fish and wildlife potentials of studied project sites.

b. Flood problems. The Androscoggin River basin is subject to flood overflows on extensive areas in industrial, commercial, and residential communities along the main stem of the river and on three tributaries, the Dead River in New Hampshire, and the Swift and Little Androscoggin Rivers in Maine. The flood of March 1936, the most damaging experienced in the basin, took four lives, made 1,500 families temporarily homeless, and caused losses estimated at $4,392,000. A more recent damaging flood occurred in March 1953 and caused losses estimated at $2,230,000. A recurrence of the experienced 1936 flood levels would cause damages of $13.7 million in the basin under present economic conditions. With increasing development of the flood plains, the recurring damage figure becomes greater. Population growth and industrial expansion tend to gravitate toward increased use of the easily developable flood plains.

c. Solutions considered. All practicable methods for solving the flood problems were considered. These included single and multiple-purpose reservoirs, local protection by dikes, floodwalls, diversion of flood waters, channel improvements, flood plain zoning, and various combinations of these methods.

SECTION XVIII - CONCLUSIONS AND RECOMMENDATIONS

53. CONCLUSIONS

The studies made for this report found that no structural measures for the control of floods, either as a single purpose project or in a multiple-purpose development, are economically feasible at the present time. It is concluded that the communities affected by flood overflow should consider the adoption of zoning measures to control future flood losses. The cities of Auburn and Lewiston, Maine have flood plain studies underway by the Corps.

The studies also found no opportunities for improvement for water supply, water quality control, or hydroelectric power. The demand for water-oriented publicly owned recreation areas is expected to increase. Further study and action at state level is needed to meet this demand.

54. RECOMMENDATIONS

The Division Engineer recommends no water resource improvements for the Androscoggin River Basin at this time. He further recommends that this report be accepted as meeting the requirements of the authorizing resolution.

REMI O. RENIER
Colonel, Corps of Engineers
Acting Division Engineer

3 Incl
1. Ltr. of comment
2. Vol. II - Appendices A thru I
3. Vol. III - Appendix J

ACKNOWLEDGEMENTS AND IDENTIFICATION OF PERSONNEL

1. The preparation of this report was administered by:

Colonel Edward J. Ribbs, Acting Division Engineer (1965-1966)
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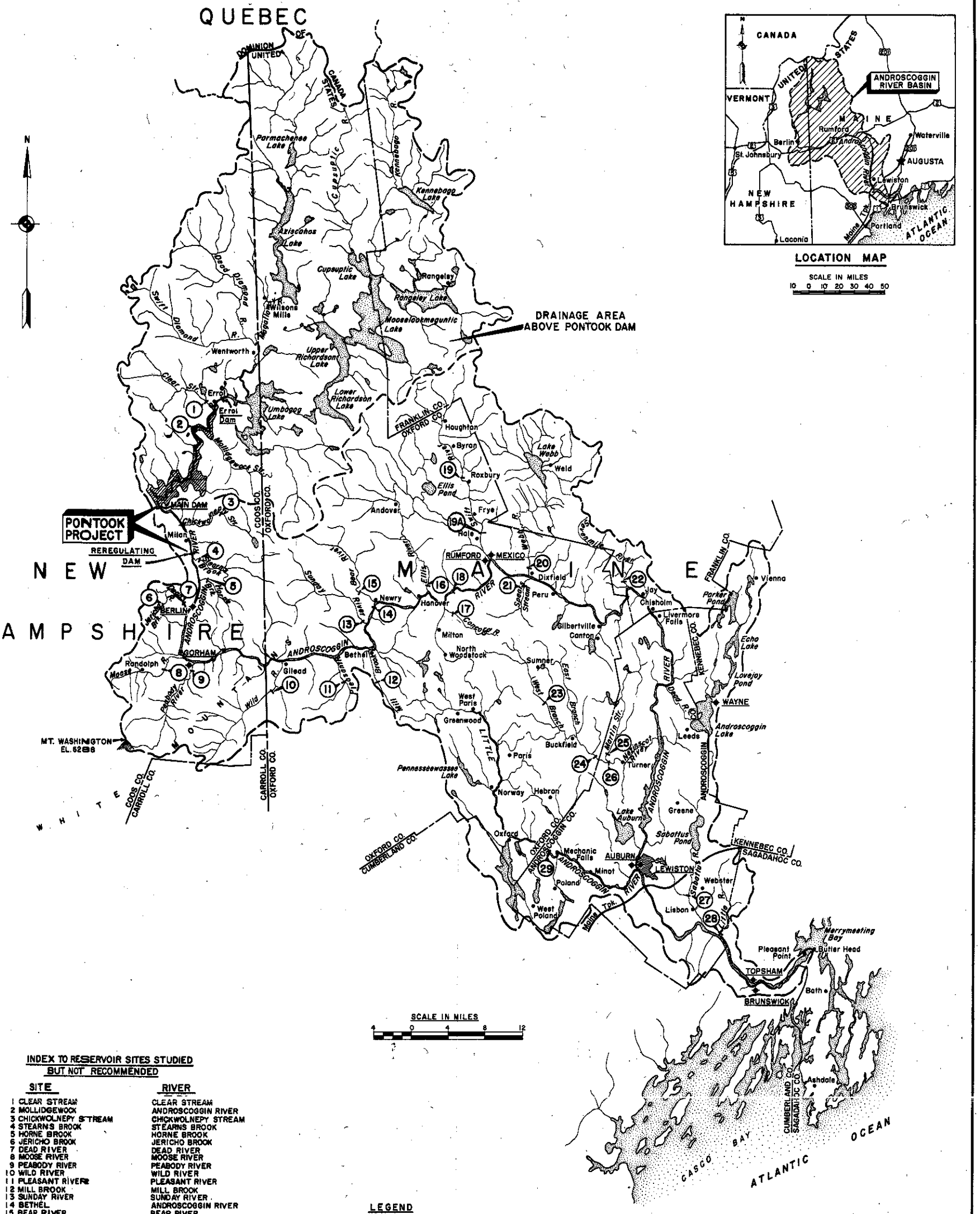
2. This report was prepared under the direction of David Cohen, Project Engineer.

3. The U. S. Army Engineer Division, New England, is appreciative of the cooperation rendered in connection with this study by personnel of other Federal agencies, State agencies, and local interests, particularly the following:

U. S. Fish and Wildlife Service
U. S. Public Health Service
Federal Power Commission
Project Director, New Hampshire State Planning Project
N. H. State Department of Public Works and Highways
Public Service Company of New Hampshire
Union Water Power Company



LOCATION MAP

SCALE IN MILES
10 0 10 20 30 40 50

INDEX TO RESERVOIR SITES STUDIED BUT NOT RECOMMENDED

SITE	RIVER
1 CLEAR STREAM	CLEAR STREAM
2 MOLLIDGEWOCK	ANDROSCOGGIN RIVER
3 CHICKWOLNEPY STREAM	CHICKWOLNEPY STREAM
4 STEARNS BROOK	STEARNS BROOK
5 HORNE BROOK	HORNE BROOK
6 JERICHO BROOK	JERICHO BROOK
7 DEAD RIVER	DEAD RIVER
8 MOOSE RIVER	MOOSE RIVER
9 PEABODY RIVER	PEABODY RIVER
10 WILD RIVER	WILD RIVER
11 PLEASANT RIVER	PLEASANT RIVER
12 MILL BROOK	MILL BROOK
13 SUNDAY RIVER	SUNDAY RIVER
14 BETHEL	ANDROSCOGGIN RIVER
15 BEAR RIVER	BEAR RIVER
16 ELLIS RIVER	ELLIS RIVER
17 CONCORD RIVER	CONCORD RIVER
18 RUMFORD	ANDROSCOGGIN RIVER
19 ROXBURY	SWIFT RIVER
19A HALE	SWIFT RIVER
20 DIXFIELD	WEBB RIVER
21 SPEARS STREAM	SPEARS STREAM
22 SEVENMILE STREAM	SEVENMILE STREAM
23 SUMNER	NEZINSCOT RIVER
24 BUCKFIELD	NEZINSCOT RIVER
25 MARTIN STREAM	MARTIN STREAM
26 TURNER	NEZINSCOT RIVER
27 SABATTUS RIVER	SABATTUS RIVER
28 LITTLE RIVER	LITTLE RIVER
29 OXFORD	LITTLE ANDROSCOGGIN RIVER

LEGEND

(1) RESERVOIR SITES STUDIED BUT NOT RECOMMENDED

✦ TOPSHAM — LOCAL PROTECTION PROJECTS STUDIED BUT NOT RECOMMENDED

PONTOOK PROJECT — MULTI-PURPOSE PROJECT REPORTED

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION - CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY L.R.M. | TR. BY M.S. G.H.D. | CK. BY D.C.

ENGINEER

PROJECT ENGINEER

CHIEF, PLANNING SECT.

CHIEF, PLANNING BRANCH

APPROVED

CHIEF, ENGINEERING DIV.

ANDROSCOGGIN RIVER BASIN, MAINE & N.H.

BASIN MAP

ANDROSCOGGIN RIVER, MAINE & N.H.

DATE JUNE 1967

TO ACCOMPANY REPORT DATED: 22 JUNE 1967

SCALE AS SHOWN

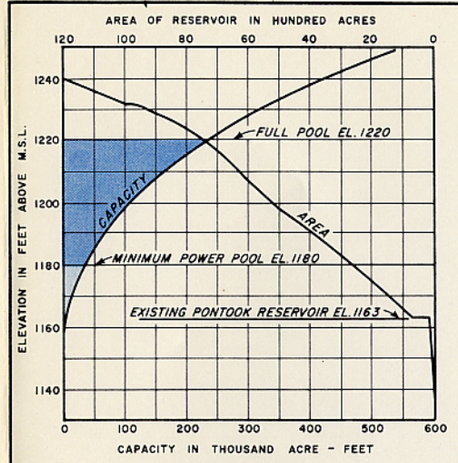
DRAWING NUMBER

SHEET 1 OF 1

PLATE NO. 1

CORPS OF ENGINEERS

U.S. ARMY



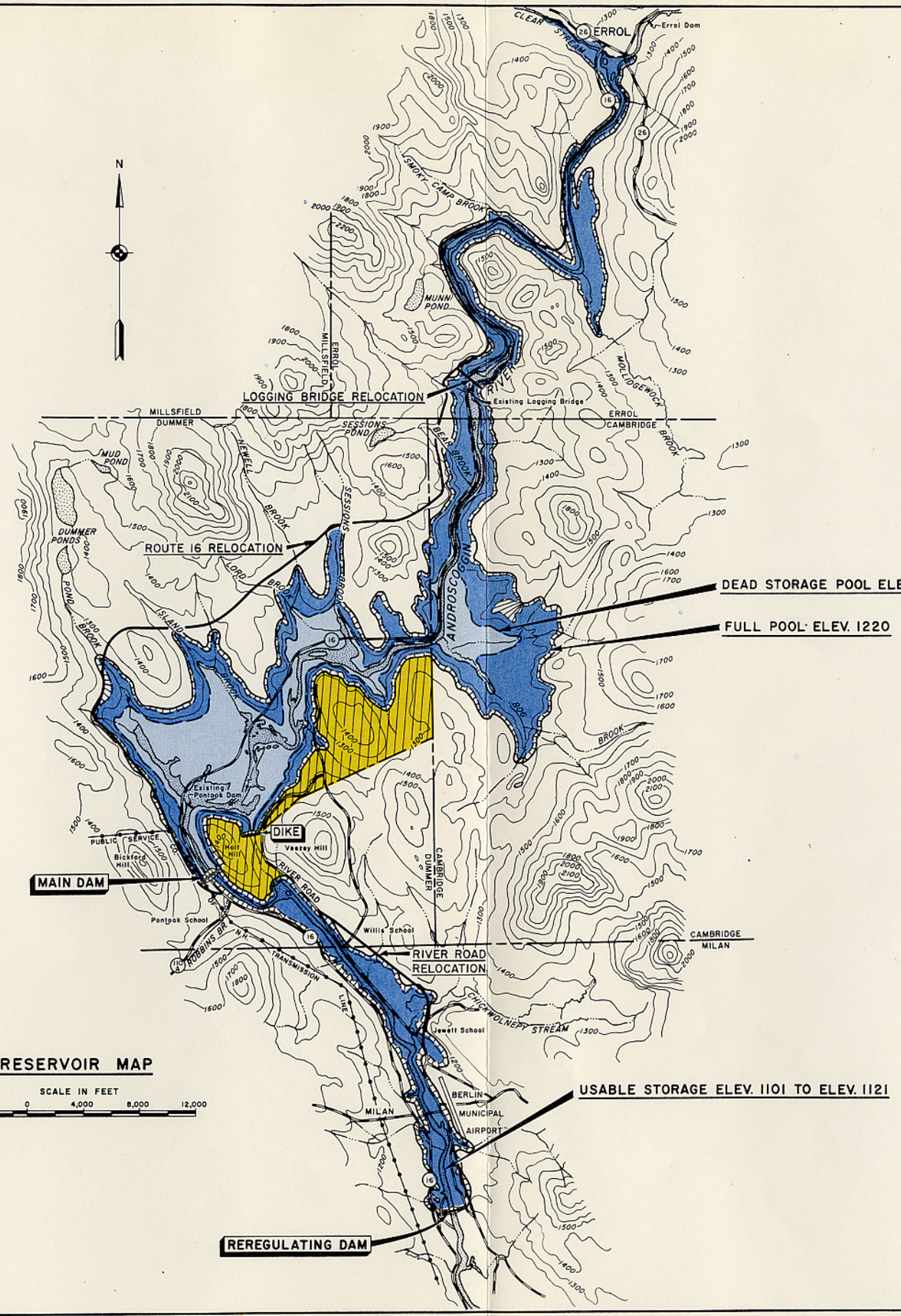
MAIN DAM

AREA AND CAPACITY CURVES

DRAINAGE AREA 170 SQ. MI. (NET)

REREGULATING DAM

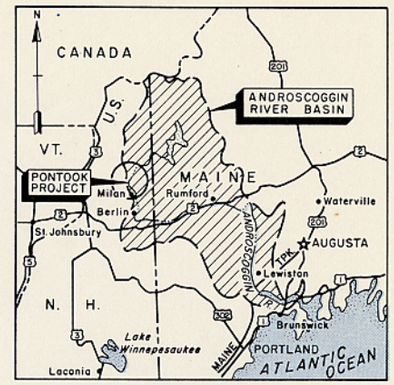
AREA AND CAPACITY CURVES



RESERVOIR MAP

SCALE IN FEET

4,000 0 4,000 8,000 12,000



LOCATION MAP

SCALE IN MILES

10 0 10 20 30 40 50

LEGEND

- EXISTING WATERWAYS
- DEAD STORAGE
- USABLE STORAGE
- PUBLIC ACCESS STRIP ADJACENT TO FULL POOL
- RECREATION LANDS
- EXISTING ROADS
- RELOCATED OR RAISED SECTIONS OF ROADS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION - CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY	TR. BY	CK. BY
J.T.S.	M.S.	D.C.

ENGINEER: John T. Smith
PROJECT ENGINEER: David Cohen
SUBMITTED: CHIEF, PLANNING, BRANCH
APPROVED: CHIEF, ENGINEERING DIV.
DATE: JUNE 1967

ANDROSCOGGIN RIVER BASIN, MAINE & N.H.

PONTOOK PROJECT
RESERVOIR MAP

ANDROSCOGGIN RIVER, NEW HAMPSHIRE

TO ACCOMPANY REPORT DATED: 22 JUNE 1967

SCALE: AS SHOWN | SPEC. NO. CIV ENG.-19-016-
DRAWING NUMBER

SHEET 1 OF 1

PLATE NO. 2

ATTACHMENT 1

LETTER OF COMMENT

FEDERAL POWER COMMISSION
REGIONAL OFFICE
346 Broadway
New York, New York 10013

March 23, 1967

Division Engineer
U. S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

Subject: Power Values
Proposed Pontook Project
Androscoggin River, New Hampshire

Dear Sir:

In response to a telephone request of Mr. E. L. Hill of your staff on March 8, 1967, we have reviewed power values for the proposed Pontook development furnished you previously by letter of April 29, 1966. These values were based on the delivered cost of an equivalent amount of power from a conventional steam-electric generating plant located on the Public Service Company of New Hampshire system. In view of the many changes occurring in the rapidly expanding electric utility industry, characterized in part by the development and widespread acceptance of EHV transmission and relatively new forms of power production, such as pumped storage for peaking, it appeared appropriate at this time to consider the advantages of this type of development as a likely alternative to Pontook.

Data is now available on several potential high head, large capacity pumped storage sites in the area which would be suitable for this purpose. A potential 500-megawatt pumped storage project with a gross head of over 1,200 feet in the vicinity of Plymouth, New Hampshire was selected as the alternative. Capital cost is estimated at $95 per kilowatt. Cost of money is taken at 7.0 percent and 3.125 percent for private and federal financing, respectively. Resultant capacity cost at bus-bar is $12.85 and $5.59 per kilowatt-year. Energy cost is estimated at 4.5 mills per kilowatt-hour, based on a pumping/generating factor of 1.5.

Transmission from the pumped storage alternative would consist of 60 miles of double circuit, steel tower, 230-kilovolt line from the alternative pumped storage site to the Merrimack steam plant, plus

a 10 mile single circuit, wood pole 115 kilovolt interconnection with Public Service at Beebe River. Annual cost including step-up and receiving end terminal equipment is estimated at $2.64 per kilowatt-year for private financing and $1.35 for federal financing.

Layout and capital cost of transmission facilities associated with delivering Pontook power to market are the same as used in our April 1966 power value determinations. As done previously, a credit was allowed in the form of a reduction in the annual cost of the project transmission facilities in recognition of its contribution to system integration.

Since Pontook would appear to have no apparent operating advantage over a pumped storage alternative, no capacity credit was assigned to it. A nominal energy liability of 0.1 mill per kilowatt-hour was applied to the at-market cost of energy from the pumped storage alternative because of the higher load factor operation of which it is capable compared to Pontook.

At-site capacity and energy values (230 kilovolt high tension bus) based on the cost of power from a pumped storage alternative and applicable to the critical year dependable capacity and average annual energy output of the proposed Pontook 300-megawatt project are as follows:

	Capacity Value ($/Kw/Yr)	Energy Value (Mills/Kwh)
Case A	10.30	4.4
Case B	13.30	4.4
Case C	4.80	4.4

Case A: Alternative pumped storage plant and associated transmission facilities and project transmission privately financed.

Case B: Alternative pumped storage plant and associated transmission facilities privately financed; project transmission federally financed.

Case C: Alternative pumped storage plant and associated transmission facilities and project transmission federally financed.

A review of latest steam-electric production costs on the Central Maine Power Company and Public Service Company of New Hampshire systems indicates that the energy value furnished you

previously of 4.0 mills per kilowatt-hour assignable to downstream energy benefits at existing hydro plants is still applicable.

If we can be of further assistance to you in your investigation of the proposed Pontook project, please let us know.

Sincerely yours,

John H. Spellman

for Paul H. Shore
Regional Engineer